

SECTION 3. TENURE ANALYSIS

We find evidence that among scientists and engineers working in academia, women are less likely to be employed in tenure-track positions than men who are similarly situated. If, however, we allow for gender differences in the effects of family characteristics, we find that gender differences in tenure-track placements are statistically insignificant. It appears that women who are married and have children are less likely to be employed in tenure-track positions than men who are married and have children.

We also find evidence that women are less likely to earn tenure than their male counterparts, partly because women are less likely to be employed in tenure-track positions. Family characteristics also appear to differentially influence tenure rates of men and women, both directly and indirectly through their relation to tenure-track placements. Some of our analyses suggest that women who have children later in their postdoctoral careers are more likely to earn tenure.

We have also looked at whether the characteristics of the employer and the primary work activities affect estimates of gender differences in tenure-track placements and tenure rates. Although these factors are related to tenure outcomes, we do not find consistent evidence that they account for gender differences in outcomes.

PHASE I TENURE-TRACK ANALYSIS

Our Phase I analyses examine differences between the sexes in achieving career outcomes at specific points in postdoctoral career paths. Below we present and interpret the results of the Phase I analysis of the tenure-track rate. The tenure-track rate is the proportion of doctorate recipients who report that they either are on tenure track or have earned tenure at academic institutions. We report data on tenure-track rates by sex and then describe the results of our multivariate analyses of

how female scientists and engineers fare relative to men in obtaining academic tenure-track positions.

PHASE I TENURE-TRACK RATES BY SEX

Table 3-1 reports estimates of tenure-track rates from the samples we used in the Phase I analysis. We estimate that among doctorate recipients with 8 or 9 years of postdoctoral experience employed full time in academia, about 87 percent (0.874) worked in tenure-track positions. Estimated tenure-track rates for men and women with comparable experience are 0.886 and 0.836, respectively. Tenure-track rates appear to be somewhat higher for Ph.D.s with 14 or 15 years of experience.

The estimates in table 3-1 are presented mainly to provide a context for interpreting the results of the multivariate analyses, below. We urge caution in interpreting the gender differences in tenure-track rates. These are simply sample-weighted population estimates and do not account for gender differences in control variables that might explain some of the variation in these rates.

PHASE I MULTIVARIATE ANALYSES OF TENURE-TRACK RATES

The major findings of our Phase I multivariate tenure-track analysis include the following:

- After accounting for controls, women with 8 or 9 years of postdoctoral experience are 3.2 to 3.3 percentage points less likely than men to be employed in tenure-track positions. The comparable estimates for women with 14 or 15 years of postdoctoral experience range from about 4.1 to 4.9 percentage points.
- If we allow for gender differences in the influence of family characteristics, gender differences in tenure-track placement rates are statistically insignificant.

TABLE 3-1. Phase I tenure-track rates by sex

Years since doctorate	Total		Male		Female	
	Sample size	Tenure-track rate	Sample size	Tenure-track rate	Sample size	Tenure-track rate
8 or 9	9870	0.874	6242	0.886	3628	0.836
14 or 15	8606	0.926	5805	0.935	2801	0.876

NOTE: Tenure-track rates are sample-weighted estimates of the proportion of Ph.D.s who reported being on tenure track or who have earned tenure at academic institutions.

SOURCE: Survey of Doctorate Recipients, 1981–1997.

- Our analyses suggest that being married and having children reduces women’s chances for employment in tenure-track positions relative to similarly situated men.
- Estimates of gender differences in tenure-track placements are relatively insensitive to the characteristics of the employer or to the primary work activity.

Table 3-2 reports the results of our multivariate analysis of tenure-track rates for doctorate recipients with 8 or 9 years of postdoctoral experience.¹ Specifically, we present results for each of the four variants of the tenure-track model described in Section 2 of this report. Each of the four models includes, as controls, variables for human capital, personal characteristics, and family characteristics, and variables that distinguish survey waves. Models 2 and 4 also include as controls selection variables reflecting primary work activity and the characteristics of the employer. Finally, the samples we used to estimate Models 3 and 4 exclude observations for doctorate recipients who report that tenure is not applicable for their positions.

TABLE 3-2. Marginal relations of female variables for Phase I tenure-track models: 8 or 9 years since doctorate

Model	Female	Female interactions		
		Married	Dependents (age <6)	Dependents (age 6 to 18)
1	-0.033*	-	-	-
2	-0.032*	-	-	-
3	-0.037*	-	-	-
4	-0.036*	-	-	-
I-1	0.011	-0.036*	-0.020*	-0.029*
I-2	0.003	-0.026	-0.019*	-0.025*
I-3	0.013	-0.040*	-0.024*	-0.034*
I-4	0.003	-0.029	-0.022*	-0.029*

*Statistically significant at 95 percent confidence.

NOTES: Models 1 and 3 exclude selection variables; Models 3 and 4 exclude Ph.D.s who reported tenure was not applicable. Models I-1 through I-4 include female-interaction variables. See Appendix C, tables C-1–8, for detailed estimates of complete models.

SOURCE: Survey of Doctorate Recipients, 1981–1997.

We also report results for each of the four models estimated with the female-interaction variables included as controls. These variables allow us to determine the extent to which a differential influence of family characteristics explains gender differences in tenure-track rates.² The models in table 3-2 labeled with a prefix “I” include the female-interaction variables.

The estimates reported in table 3-2 give the marginal relations between the female and female-interaction variables and the probability of a doctorate recipient being employed in a tenure-track position.³ For example, the estimated marginal relation for the female variable for Model 1 is -0.033. This means that, after accounting for controls, female doctorate recipients are 3.3 percentage points less likely than their male counterparts to be employed in a tenure-track position.⁴

Table 3-3 reports the results of the multivariate tenure-track analysis for doctorate recipients with 14 or 15 years of postdoctoral experience. These estimates can be interpreted similarly to those in table 3-2. For example, the estimated marginal relation for the female variable for Model 1 is -0.045. This estimate indicates that, after accounting for controls, women with 14 or 15 years of postdoctoral experience are about 4.5 percentage points less likely to be employed in tenure-track positions than their male counterparts.

Results for Female-Interaction Variables

The last four rows of tables 3-2 and 3-3 show estimated marginal relations for models that include the female-interaction variables as controls. These four models allow for gender differences in the marginal relations between family characteristics and the likelihood of employment in tenure-track positions. One way to interpret the influence of the female-interaction variables is by pair-wise comparisons of models with and without the interactions. In table 3-2, for example, the estimated

² Note that all of the models include family characteristics as controls. The female-interaction variables allow us to measure how gender differences in family effects influence estimates of gender differences in tenure-track rates.

³ See Appendix A for a more detailed, technical interpretation of the marginal relations.

⁴ The estimated marginal relations can be placed in context by comparing them to the tenure-track rates reported in table 3-1. For example, the overall tenure-track rate for doctorate recipients with 8 or 9 years of experience is 0.874. Thus, a marginal gender difference of -0.033 is about 3.8 percent of the overall tenure-track rate (i.e., $100 \times 0.033/0.874$).

¹ The tables in this section of the report present results for the female variables of interest. Estimates for the complete models, including the coefficients of the control variables, are reported in Appendices C and D.

TABLE 3-3. Marginal relations of female variables for Phase I tenure-track models: 14 or 15 years since doctorate

Model	Female	Female interactions		
		Married	Dependents (age <6)	Dependents (age 6 to 18)
1	-0.045*	-	-	-
2	-0.041*	-	-	-
3	-0.049*	-	-	-
4	-0.043*	-	-	-
I-1	-0.007	-0.037*	0.007	-0.017*
I-2	-0.008	-0.030*	0.006	-0.016*
I-3	-0.008	-0.038*	0.007	-0.021*
I-4	-0.010	-0.029*	0.004	-0.018*

* Statistically significant at 95 percent confidence.

NOTES: Models 1 and 3 exclude selection variables; Models 3 and 4 exclude Ph.D.s who reported tenure was not applicable. Models I-1 through I-4 include female-interaction variables. See Appendix C, tables C-9–16, for detailed estimates of complete models.

SOURCE: Survey of Doctorate Recipients, 1981–1997.

marginal relation for the female variable for Model 1 is -0.033 and is statistically significant. Model I-1 is specified the same as Model 1, except the former includes the female-interaction variables. The estimated coefficient of the female variable is small (0.011) and is statistically insignificant. In other words, if we allow for gender differences in the influences of family characteristics, we cannot reject the hypothesis that women and men are equally likely to be employed in tenure-track positions. This conclusion holds for all four variants of the interaction models presented in tables 3-2 and 3-3.

The marginal relations of the female-interaction variables can be interpreted similarly. In table 3-2, for example, the estimated marginal relation for the “married” variable for Model I-1 is -0.036 . This indicates that married women are 3.6 percentage points less likely than married men with the same characteristics to be employed in tenure-track positions. Estimated marginal relations for the “dependents” variables of Model 1 indicate that compared with their male counterparts, each dependent under the age of 6 and each dependent between the ages of 6 and 18 decrease tenure-track placement chances for women by 2.0 and 2.9 percentage points, respectively.

Each of the estimated marginal relations reported in table 3-2 for the two dependents variables is negative and statistically significant, suggesting that women with 8 or 9 years of postdoctoral experience and with children under their care are less likely to be employed in tenure-track positions than are similarly situated men. Each estimate for the married variable is also negative,

but only those for Models I-1 and I-3 are statistically significant.

Table 3-3 reports the estimated marginal relations for the female-interaction variables for doctorate recipients with 14 or 15 years of postdoctoral experience. The coefficients for the variables “married” and “dependents (ages 6 to 18)” are all negative and statistically significant, suggesting that, relative to men, these family characteristics reduce women’s chances for tenure-track positions. The estimated marginal relations for the variable “dependents (age <6)” are all small and statistically insignificant. We suspect that this result occurs because of fertility timing. Many women with 14 or 15 years of postdoctoral experience and young children under their care are likely to have had fewer children earlier in their careers. The results in table 3-2 for less-experienced doctorate recipients suggest that women who postpone having children earlier in their careers are more likely to be employed in tenure-track positions.

We urge caution in interpreting causal relations between the female-interaction variables and chances for employment in tenure-track positions. The possibility of self-selection is of particular concern. If women, as a group, tend to be more pessimistic than men about their chances for earning tenure, they might choose employment in nontenure-track positions and have children early in their postdoctoral careers. If this occurs, the female-interaction variables will reflect, at least partially, the consequences of adverse selection rather than gender differences in the influence of family responsibilities on chances for career success.

Results for Selection Variables

Two of the four tenure-track models we have estimated include selection variables as controls. These sets of variables distinguish kinds of primary work activities and characteristics of the employing institution (whether the employer is a research, doctoral, or other kind of institution, and whether the institution is private or public). Our estimates of gender differences in tenure-track rates do not appear to be sensitive to the selection variables. For example, although the selection variables are included as controls in Models 2 and 4 of table 3-2 and excluded from Models 1 and 3, pair-wise comparisons of the estimated coefficients for the variable “female” indicate that these alternative model specifications yield nearly the same marginal relations. Differences between model specifications in the estimated marginal relations for the female variable reported in table 3-3 are also small and are certainly within the range of statistical error in the

estimates. Statistically, we find about the same gender differences in tenure-track rates whether or not we control for work activity and characteristics of the employer.

Our finding that the selection variables do not seem to affect our estimates of gender differences does not imply that the selection variables have no relation to tenure-track rates. Indeed, we find that doctorate recipients who report teaching as a primary work activity rather than other work and those who report being employed at doctoral rather than nondoctoral institutions are more likely to be placed in tenure-track positions. Those who report being employed at private rather than public institutions are less likely to be placed in tenure-track positions.⁵ However, based on the results reported in tables 3-2 and 3-3, we do not find evidence that the selection variables affect estimates of gender differences in tenure-track rates.⁶

Results for Tenure Not Applicable

Our estimates of gender differences in tenure-track rates also appear to be relatively insensitive to whether we include observations for doctorate recipients who report that tenure is not applicable for their positions. The samples we used to estimate Models 1 and 2 include the observations for the tenure-not-applicable positions; they are excluded from the samples used to estimate Models 3 and 4. Differences in our estimates of the marginal relations for the female variable are relatively close for these alternative models and are certainly within the range of statistical error. The same conclusion holds for our estimates of the female-interaction variables.

PHASE I TENURE ANALYSIS

Below, we present data on tenure rates by sex and then describe the results of our multivariate analyses of gender differences in tenure success rates.

⁵ See Appendix C, tables C-2, C-4, C-6, C-8, C-10, C-12, C-14, and C-16.

⁶ Comparing results for Models I-1 and I-3 with Models I-2 and I-4 in tables 3-2 and 3-3 suggests that estimates of the coefficients of the female-interaction variables are also relatively insensitive to selection variables.

PHASE I TENURE RATES BY SEX

Table 3-4 reports population estimates of tenure rates from the samples we used in the Phase I analyses. For example, we estimated an overall tenure rate of 0.476 (47.6 percent) for doctorate recipients with 8 or 9 years of postdoctoral experience. The comparable rates for men and women with the same experience are 0.503 and 0.385, respectively. Tenure rates for more experienced doctorate recipients are higher, 0.772 overall for those with 14 or 15 years of postdoctoral experience. The results reported in table 3-4 do not account for other factors that might affect tenure rates, and gender differences in the estimated tenure rates should be interpreted accordingly.

PHASE I MULTIVARIATE ANALYSES OF TENURE RATES

The study design we used for our multivariate analysis of tenure rates is similar to the design described above for the tenure-track analysis. Specifically, we show results for variants of the tenure model with and without the selection variables, observations on “tenure not applicable,” and female-interaction variables. We also estimated tenure models with and without observations on doctorate recipients who reported employment in non-tenure-track positions.

The major findings of our Phase I multivariate tenure analysis include the following:

- After accounting for controls, women are less likely than men to be tenured. Gender differences in tenure rates decline if we exclude from our samples doctorate recipients employed in nontenure-track positions.
- Our analysis suggests that women’s chances for earning tenure are influenced by family characteristics, both directly and indirectly through the relation of family characteristics to the likelihood of being employed in tenure-track positions.
- Having young children later in their careers is positively related to women’s chances for earning tenure.

TABLE 3-4. Phase I tenure rates by sex

Years since doctorate	Total		Male		Female	
	Sample size	Tenure rate	Sample size	Tenure rate	Sample size	Tenure rate
8 or 9	9870	0.476	6242	0.503	3628	0.385
14 or 15	8606	0.772	5805	0.794	2801	0.662

NOTE: Tenure rates are sample-weighted estimates of the proportion of Ph.D.s who reported being tenured.

SOURCE: Survey of Doctorate Recipients, 1981–1997.

- Estimates of gender differences in tenure rates are relatively insensitive to the characteristics of the employer or to the primary work activity.

Table 3-5 reports Phase I estimates of the marginal relations between the female and female-interaction variables and the probability of receiving tenure for doctorate recipients with 8 or 9 years of postdoctoral experience. For example, the estimated marginal relation for Model 1 is -0.069 , meaning that, after accounting for controls, these women are about 6.9 percentage points less likely to be tenured than similarly situated men.⁷ In the six models that exclude the female-interaction variables, estimates of the marginal relations range from -0.054 to -0.074 (table 3-5).

Phase I estimates of the marginal relations between the female variables and tenure for doctorate recipients with 14 or 15 years of postdoctoral experience are reported in table 3-6. Estimates of the marginal relations between the female variables and the probability of being tenured range from -0.034 and -0.088 for Models 1 through 6.

Results for Female-Interaction Variables

A comparison of the results for Models 1 through 4 and I-1 through I-4 of the Phase I tenure analysis suggests a link between lower tenure rates for women and family characteristics. When we exclude the female-interaction variables (Models 1 through 4), women with 8 or 9 years of postdoctoral experience are about 7 percent less likely to be tenured than their male counterparts (table 3-5). If, however, we allow for gender differences in the influence of family characteristics (Models I-1 through I-4), the estimated marginal relations for the female variable fall to about 3 or 4 percent, and none is statistically insignificant. The results for women with 14 or 15 years of postdoctoral experience (table 3-6) are even more striking. Without the female-interaction variables, we estimate that women are about 8 or 9 percentage points less likely to be tenured than men. However, when we allow for gender differences in the influence of family characteristics, estimates of the coefficients of the female variable fall to about 1.5 percent and are statistically insignificant. All the estimates of the marginal

⁷ The estimated marginal relations can be placed in context by comparing them to the tenure rates reported in table 3-4. For example, the overall tenure-track rate for doctorate recipients with 8 or 9 years of experience is 0.476. Thus, a marginal gender difference of -0.069 is about 14.5 percent of the overall tenure rate (i.e., $100 \times 0.069/0.476$).

relations for the variable “dependents (age <6)” of Models I-1 through I-4 are negative and statistically significant (table 3-5).

For women with 8 or 9 years of postdoctoral experience, the estimates of the marginal relations for the female-interaction variables are all negative and are statistically significant for dependents under the age of six (table 3-5). Results for this variable are different, however, among women with 14 or 15 years of postdoctoral experience (table 3-6). Although the estimated coefficients for the variables reflecting marital status and the number of dependents between ages 6 and 18 are negative, the marginal relations for dependents under the age of six are positive. Taken at face value, this suggests that women with 14 or 15 years of doctoral experience increase their chances for tenure by having young children, but we caution against assigning causality from this result. More likely, the positive marginal relations reported in table 3-6 reflect the effects of fertility timing. If women who were without children earlier in their careers were more successful in getting tenure, then started families, we would expect to observe a positive relation between tenure rates and having children later in their careers. This interpretation is consistent with the results reported in table 3-5 for less-experienced doctorate recipients, which show that women with young children have lower

TABLE 3-5. Marginal relations of female variables for Phase I tenure models: 8 or 9 years since doctorate

Model	Female	Female interactions		
		Married	Dependents (age <6)	Dependents (age 6 to 18)
1	-0.069^*	-	-	-
2	-0.069^*	-	-	-
3	-0.074^*	-	-	-
4	-0.072^*	-	-	-
5	-0.059^*	-	-	-
6	-0.054^*	-	-	-
I-1	-0.035	-0.013	-0.039^*	-0.031
I-2	-0.041	-0.008	-0.038^*	-0.027
I-3	-0.036	-0.018	-0.041^*	-0.030
I-4	-0.039	-0.012	-0.041^*	-0.027
I-5	-0.055^*	0.005	-0.023	-0.001
I-6	-0.054^*	0.010	-0.022	-0.001

*Statistically significant at 95 percent confidence.

NOTES: Models 1 and 3 exclude selection variables; Models 3 and 4 exclude Ph.D.s who reported tenure “not applicable”; Models 5 and 6 exclude Ph.D.s who reported nontenure-track positions. Models I-1 through I-6 include female-interaction variables. See Appendix C, tables C-17–28 for detailed estimates of complete models.

SOURCE: Survey of Doctorate Recipients, 1981–1997.

TABLE 3-6. Marginal relations of female variables for Phase I tenure models: 14 or 15 years since doctorate

Model	Female	Female interactions		
		Married	Dependents (age <6)	Dependents (age 6 to 18)
1	-0.085*	-	-	-
2	-0.084*	-	-	-
3	-0.088*	-	-	-
4	-0.083*	-	-	-
5	-0.041*	-	-	-
6	-0.034*	-	-	-
I-1	-0.012	-0.076*	0.057*	-0.044*
I-2	-0.013	-0.069*	0.049*	-0.047*
I-3	-0.015	-0.078*	0.057*	-0.039*
I-4	-0.015	-0.071*	0.051*	-0.038*
I-5	-0.008	-0.042*	0.054*	-0.018*
I-6	-0.006	-0.035*	0.047*	-0.016*

*Statistically significant at 95 percent confidence.

NOTES: Models 1 and 3 exclude selection variables; Models 3 and 4 exclude Ph.D.s who reported tenure was not applicable; Models 5 and 6 exclude Ph.D.s who reported nontenure-track positions. Models I-1 through I-6 include female-interaction variables. See Appendix C, tables C-29–40, for detailed estimates of complete models.

SOURCE: Survey of Doctorate Recipients, 1981–1997.

chances for tenure early in their careers. It is also consistent with the results reported in table 3-6 for dependents between ages 6 and 18. The estimated marginal relations for older dependents are negative, suggesting that women who had children early in their careers have lower chances for tenure later in their careers (i.e., 14 or 15 years after earning their doctorates).

There are also differences between tables 3-5 and 3-6 in the estimated marginal relations for the variable “married.” The estimates are relatively small and are statistically insignificant for less-experienced doctorate recipients (table 3-5) but are negative and statistically significant for more experienced doctorate recipients (table 3-6). It could be that the immobility associated with being married is more of a constraint later in women’s careers, after their spouses have established careers of their own.

Results for Nontenure-Track Positions

Estimates of gender differences in tenure rates decline if nontenure-track positions are excluded, as shown in the results for Models 5 and 6 of the tenure analysis. In table 3-6, for example, the estimated marginal relations for the female variable fall from 8 or 9 percent for Models 1 through 4, which include observations

for nontenure-track positions, to 3 or 4 percent for Models 5 and 6, which exclude observations for nontenure-track positions. These results are consistent with our early finding that women are less likely than men to be employed in tenure-track positions. This, of course, lowers women’s chances of earning tenure.

Above, we reported evidence suggesting that having children is negatively related to women’s chances for employment in tenure-track positions. The results of our tenure analysis are consistent with this finding. We did not observe substantial declines in the estimated marginal relations for the female variable in Models I-5 and I-6 compared with Models I-1 through I-4. This might reflect the indirect, differential influence exerted by family characteristics on the tenure rates of men and women through the effects of family characteristics on tenure-track rates. The coefficients of the female-interaction variables in Models I-1 through I-4 capture the indirect influence of the family variables on tenure rates through their relations with tenure-track rates. As a result, removing observations on nontenure-track positions from the samples used to estimate Models I-5 and I-6 does not result in substantial changes in estimates of gender difference in tenure rates. The behavior of the estimates of the marginal relations of the female-interaction variables is consistent with this interpretation. For Models I-5 and I-6, the estimates are statistically insignificant in table 3-5, and the influences of the marital-status and older-dependents variables decline noticeably in table 3-6. We would expect the influence of the female-interaction variables to decline when we eliminate the effects of gender differences in tenure-track rates by removing nontenure-track positions from the sample.

Results for Selection Variables

The even-numbered tenure models reported in tables 3-5 and 3-6 include selection variables as controls. These variables distinguish kinds of primary work activities and characteristics of the employing institution. The estimates of gender differences in tenure rates do not appear to be sensitive to the selection variables. Pair-wise comparisons of the estimated coefficients for the female variable indicate that the alternative model specifications, which include (Models 2, 4, 6) or exclude (Models 1, 3, 5) selection variables as controls, yield similar estimates of marginal relations for the female variables. For women with 14 or 15 years of postdoctoral experience, differences in the estimated marginal relations across model specifications are also small for the female variable and

are within the range of statistical error in the estimates (table 3-6).⁸ In summary, we find statistically about the same gender differences in tenure rates when we control for work activity and characteristics of the employer.

Our finding that the selection variables do not appear to affect our estimates of gender differences does not imply that the selection variables have no relation to tenure rates. Doctorate recipients who report that the primary work activity is teaching rather than other work and those who report being employed at doctoral rather than nondoctoral institutions are more likely to have earned tenure. Those who report being employed at private rather than public institutions are less likely to have earned tenure.⁹ However, based on the results reported in tables 3-5 and 3-6, we do not find evidence that work activity or employer characteristics affect estimates of gender differences in tenure rates.

Results for Tenure Not Applicable

Our estimates of gender differences in tenure rates also appear to be relatively insensitive to whether we include observations for doctorate recipients who report that tenure is not applicable for their positions. The samples we used to estimate Models 1 and 2 include the observations for the tenure-not-applicable positions; they are excluded from the samples used to estimate Models 3 and 4. Differences in our estimates of the marginal relations for the female variable are relatively close for these alternative models and are certainly within the range of statistical error. The same conclusion holds for our estimates of the female-interaction variables.

⁸ Estimates of the marginal relations for the female-interaction variables reported in tables 3-5 and 3-6 are also relatively insensitive to whether the selection variables are included as controls.

⁹ See Appendix C, tables C-18, C-20, C-22, C-24, C-26, C-28, C-30, C-32, C-34, C-36, C-38, C-40.

PHASE II TENURE ANALYSIS

In the discussion that follows, we present and interpret the results of the Phase II tenure analysis, which uses a sample of doctorate recipients who reported full-time academic employment in the 1997 SDR wave and includes work-history variables as controls.¹⁰

PHASE II TENURE RATES BY SEX

Our objective in the Phase II tenure analysis was to estimate gender differences in the likelihood of doctorate recipients earning tenure at any given time in their careers. The statistical method we used—multivariate hazard analysis—takes into account whether an individual had received tenure as of the date of the 1997 SDR wave and the amount of time it took to earn tenure.¹¹

Table 3-7 reports sample-weighted estimates of the relevant statistics. Based on the 1997 SDR data, we estimate that 53.4 percent of science and engineering doctorate recipients employed full-time in academia were tenured as of the date of the 1997 SDR wave.

Table 3-7 also shows sample-weighted estimates of the amount of time it took to earn tenure, measured from the year that the doctorate was earned, for those individuals who reported that they had received tenure either before or as of the date of the 1997 SDR wave. We estimate that it took doctorate recipients overall an average of 8.61 years to earn tenure.

¹⁰ We also used a different statistical model, multivariate hazard analysis, in the Phase II analysis. In the Phase I analysis we used multivariate logit analysis. See Appendix A for technical details.

¹¹ The hazard model also considers the amount of time elapsed since earning the doctorate for those individuals in the sample who had not yet earned tenure as of the date of the 1997 SDR wave.

TABLE 3-7. Phase II tenure rates and years to tenure by sex

Outcome	Total		Male		Female	
	Sample size	Tenure outcome	Sample size	Tenure outcome	Sample size	Tenure outcome
Tenure rate	5305	0.534	3548	0.574	1757	0.439
Years to tenure	2732	8.61	1950	8.66	782	8.46

NOTES: Tenure rates and years to tenure (years since earning doctorate) are sample-weighted estimates. Years-to-tenure estimates exclude censored observations.

SOURCES: Sample drawn from Survey of Doctorate Recipients, 1997; work-history data drawn from Survey of Doctorate Recipients, 1981–1997.

We offer the usual caveat about interpreting gender differences in the statistics reported in table 3-7. These are simply weighted estimates from the sample we used and do not account for other factors that might affect the likelihood of tenure. Moreover, the estimates of time taken to earn tenure exclude censored observations. An observation is censored if, as of the date of the 1997 SDR wave, the individual has never reported being tenured.¹²

PHASE II MULTIVARIATE ANALYSES OF TENURE RATES

For the most part, the results of our Phase II tenure analysis are consistent with the findings reported above for the Phase I analysis. After accounting for controls, women are less likely than men to be tenured; however, if we allow for gender differences in the effects of family characteristics, gender differences in the probability of being tenured are statistically insignificant.

Table 3-8 reports the results of the Phase II multivariate tenure analysis for four alternative model specifications. All four models include as controls variables for human capital, personal and family characteristics, and when the doctorate was earned.¹³ In addition, Model 2 includes an outcome-status variable that measures the percentage of time before tenure (or the percentage of time before the 1997 SDR wave for untenured doctorate recipients) that the individual reported employment in positions in which tenure was not applicable. Model 3 includes a set of work-history variables that reflect the percentage of time before earning tenure that the individual reported either not working in academia full time, working at a research institution, working at a doctoral institution, research as a primary work activity, or teaching as a primary work activity. Model 3 does not include the outcome-status variable as a control. Model 4 includes variables for both outcome status and work history.

The estimated marginal relations in table 3-8 are interpreted differently from those for the Phase I tenure analyses because they show the relations between the variables of interest and the ratio of women's tenure success rates to men's. For example, the estimated marginal

¹² The hazard model we employed does, however, use information on the amount of time elapsed since earning the doctorate for censored observations. Thus, the sample sizes used in the Phase II multivariate tenure analysis are those reported in table 3-7 for tenure rates and not the smaller sample sizes reported for estimates of years to tenure.

¹³ See Section 2, table 2-4 for a detailed list of control variables.

TABLE 3-8. Marginal relations of female variables for Phase II tenure models

Model	Female	Female interactions		
		Married	Dependents (age <6)	Dependents (age 6 to 18)
1	0.846*	-	-	-
2	0.880*	-	-	-
3	0.898*	-	-	-
4	0.931	-	-	-
I-1	0.931	1.023	0.880	0.824*
I-2	0.970	0.952	0.895	0.911
I-3	0.957	1.037	0.905	0.856*
I-4	0.993	0.959	0.937	0.949

*Statistically significant at 95 percent confidence.

NOTES: Model 1 excludes selection variables for outcome status and employment status; Model 2 excludes outcome status but includes employment status; Model 3 includes outcome status but excludes employment status; Model 4 includes both outcome status and employment status. Models I-1 through I-4 include female-interaction variables. See Appendix D, tables D-1-8, for detailed estimates of complete models.

SOURCES: Sample drawn from Survey of Doctorate Recipients, 1997; work-history data drawn from Survey of Doctorate Recipients, 1981-1997.

relation of 0.846 for the female variable for Model 1 means that, after accounting for controls, the chance of a woman earning tenure is about 84.6 percent of the chance of a man earning tenure. An estimated marginal relation less than 1.0 means that the variable of interest is negatively related to women's chances for tenure relative to similarly situated men. An estimated marginal relation greater than 1.0 indicates the variable of interest is positively related to women's relative chances of earning tenure.

Results for Female-Interaction Variables

The last four rows in table 3-8 report results for models that include the female-interaction variables as controls.¹⁴ None of the estimated marginal relations for the female variable is statistically significant, consistent with our findings from the Phase I analysis. After controlling for gender differences in the effects of family variables, we cannot reject statistically the hypothesis that tenure rates for men and women are the same.

Table 3-8 also reports estimates of the marginal relations for the female-interaction variables. The estimated marginal relations for the dependents variables are

¹⁴ The Phase II tenure analysis measures all family variables—including the female-interaction variables—three survey waves, or about six years, from the date that the doctorate was earned.

less than 1.0 for all four alternative specifications of the female-interactions variables but are statistically significant in only two of eight cases. None of the coefficients of the marital-status variable is significant.

Results for Outcome-Status and Work-History Variables

The estimated marginal relation for the female variable in Model 1, which excludes both the outcome-status and work-history variables, is 0.846. For Models 2 and 3, which alternately include the outcome-status and work-history variables, the comparable estimates are 0.880 and 0.898, respectively. These last two estimates are closer to 1.0, which might imply smaller gender differences in promotion rates; however, the differences in the marginal relations between Models 1, 2, and 3 are within the range of statistical error. Model 4, which includes both the outcome-status and work-history variables, yields the highest marginal relation for the female variable (0.931). The difference between the estimates for Models 1 and 4 is about two standard deviations away from the standard errors of the estimated coefficients.¹⁵ This suggests that some of the gender differences in tenure rates might

be explained by variations in outcome status and work histories. But we reiterate our earlier caution about interpreting the results models using these variables as controls. Both outcome status and work history are selection variables in that they reflect career outcomes. As a result, the same forces that influence gender differences in tenure rates, including discriminatory treatment of women, could determine these variables.¹⁶

We do note, however, that the estimated coefficients of the outcome status and most of the work-history variables are statistically significant. As might be expected, spending time in nontenure positions reduces the likelihood of an individual earning tenure at any given point in the career path. Also, spending time employed at research and doctoral institutions lowers an individual's chance for tenure relative to employment at other kinds of academic institutions. This result is not surprising, given that research and doctoral institutions are likely to have the most stringent requirements for tenure. Finally, those who report spending time engaged in teaching as a primary work activity have higher chances of earning tenure than those involved in other activities.¹⁷

¹⁵ Specifically, the differences in the estimates of the coefficients of the hazard function are about two standard deviations apart. See Appendix D, tables D-1 and D-4.

¹⁶ See Section 2 for a detailed discussion of the interpretation of selection variables.

¹⁷ See Appendix D, tables D-2, D-3, D-4, D-6, D-7, and D-8.